I. PATENT ABSTRACTS OF JAPAN

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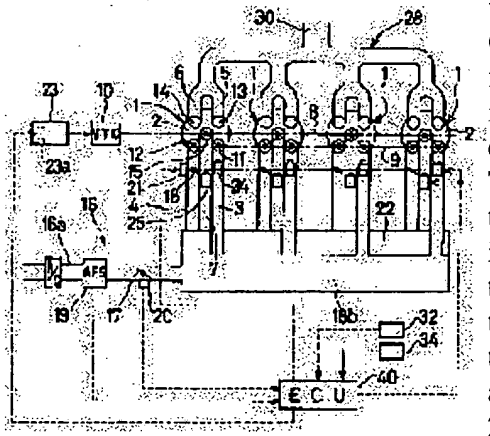
(54) INTAKE DEVICE OF ENGINE



(57)Abstract:
PURPOSE: To favorably supply air-fuel mixture for generating stratification in a combustion chamber without using any special air pressurizing means.
CONSTITUTION: A center injector 25 for forming air-fuel mixture is provided in a center port 7, and the space in an air-fuel mixture supply part constituted of the center port 7 and the like is formed into a closed space. The opening timing of a timing valve 15 opening/closing the center port 7 is delayed from the opening timing of intake valves 11, 12, the former opening timing is set on the way of a compression stroke, and during the opening timing of the timing valve 15, air-fuel mixture formed in the center port 7 is supplied into a combustion chamber 2 and then the combustion gas in the combustion chamber 2 is taken in the center port 7 side. In addition, at high speed operation of the engine, the closing timing of the timing valve 15 is delayed from that at low speed operation, so as to introduce combustion gas of higher pressure into the center port 7.

CLAIMS

[Claim(s)]
[Claim 1] Opening is carried out to the above-mentioned combustion chamber with the main suction port which carries out opening to a combustion chamber, and is opened and closed by the inlet valve. In the engine with which it has a feed zone and the valve-opening stage of the above-mentioned closing motion valve was set up at the stage later than the valve-opening stage of the above-mentioned inlet valve and the gaseous mixture which supplies the gaseous mixture of air and a fuel to a combustion chamber after it was opened and closed by the closing motion valve and this closing motion valve has opened -- the above -- gaseous mixture -- the clausilium stage of the above-mentioned closing motion valve with a stage adjustable means to make it change in the range within a compression stroke, while making space in a feed zone into closing space The suction system of the engine characterized by having the stage control means which controls the above-mentioned stage adjustable means to delay the clausilium stage of the above-mentioned closing motion valve rather than the time of low r.p.m. operation at the time of engine high-speed operation.
[Claim 2] The suction system of the engine characterized by constituting the above-mentioned stage control means in the suction system of an engine according to claim 1 so that an engine speed may delay the clausilium stage of the above-mentioned closing motion valve rather than the time of low load driving in the field below fixed at the time of heavy load operation.
[Claim 3] the low-speed operating range which is under the predetermined rotational frequency to which the engine speed was beforehand set in the suction system of an engine according to claim 1 or 2 -- gaseous mixture -- an inside high-speed operating range with an engine speed make fuel injection perform within a feed zone, and higher than the above-mentioned low-speed operating range -- the above -- gaseous mixture -- the suction system of the engine characterized by having the fuel-injection control means to which stop the fuel injection within a feed zone and fuel injection is made to carry out by the above-mentioned main suction port.
[Claim 4] Fuel injection is made to perform within a feed zone. the low-speed operating range which is under the predetermined rotational frequency to which the engine speed was beforehand set in the suction system of an engine according to claim 1 or 2 -- gaseous mixture -- Stop the fuel injection within a feed zone and fuel injection is made to perform by the above-mentioned main suction port. an inside high-speed operating range with an engine speed higher than the above-mentioned low-speed operating range -- in principle -- the above -- gaseous mixture -- the case where it is in the important point cooling conditions that engine operational status was beforehand set up even if it was in a high-speed operating range during the above -- exceptional -- the above -- gaseous mixture -- the suction system of the engine characterized by having the fuel-injection control means to which fuel injection is made to carry out within a feed zone.
[Claim 5] It is the suction system of the engine characterized by being that the above-mentioned important point cooling conditions have engine operational status in a high-speed operating range of the high-speed operating range during the above in the suction system of an engine according to claim 4.
[Claim 6] The above-mentioned important point cooling conditions are the suction system of the engine characterized by being that knocking more than predetermined reinforcement is detected in the suction system of an engine according to claim 4 or 5.
[Claim 7] The suction system of the engine characterized by constituting the above-mentioned swirl control means so that the opening of the above-mentioned swirl control valve may be increased rather than the case where an engine is in a combustion unstable state when an engine

is in a combustion stable state while having the swirl control means which is equipped with two or more main suction ports, prepares a swirl control valve only in some main suction ports of them in the suction system of an engine according to claim 1 to 6, and controls the opening of this swirl control valve.

[Claim 8] The suction system of the engine characterized by constituting the above-mentioned swirl control means so that the opening of the above-mentioned swirl control valve may be decreased rather than other cases when knocking more than predetermined reinforcement has occurred in the engine while having the swirl control means which is equipped with two or more main suction ports, prepares a swirl control valve only in some suction ports of them in the suction system of an engine according to claim 1 to 6, and controls the opening of this swirl control valve.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] gaseous mixture for the main suction port to supply the gaseous mixture of air and a fuel to a combustion chamber independently, as for this invention -- a feed zone is related with the suction system of the engine which carries out opening to the above-mentioned combustion chamber.

[0002]

[Description of the Prior Art] Conventionally, what is shown in JP,62-18335,A is known as an engine suction system. the gaseous mixture for supplying the gaseous mixture which mixed air and a fuel beforehand to the above-mentioned combustion chamber with this equipment apart from the main suction port (an official report the 1st suction port and the 2nd suction port) with the usual inlet valve -- the feed zone (the 3rd suction port) is carrying out opening to this combustion chamber. this gaseous mixture -- the above-mentioned inlet valve and the same closing motion valve are prepared in a feed zone, and that valve-opening stage is set up at the stage later than the valve-opening stage of the above-mentioned inlet valve. after the inhalation-of-air initiation which leads the above-mentioned main suction port according to such equipment, and this -- becoming independent -- the above -- gaseous mixture -- by supplying the gaseous mixture generated beforehand to a combustion chamber from a feed zone, a combustion chamber is stratification-ized and good Lean combustion is realized.

[0003]

[Problem(s) to be Solved by the Invention] the equipment of the above-mentioned official report -- gaseous mixture -- the supercharger with which an inhalation-of-air path is open for free passage with a supercharger, and the 3rd suction port which is a feed zone is prepared in this inhalation-of-air path upstream -- using -- the 3rd suction port of the above -- gaseous mixture -- the pressurization air for formation is introduced and gaseous mixture is supplied to a combustion chamber by the differential pressure of the pressure of this air, and combustion chamber internal pressure. however -- such -- gaseous mixture -- the case where a supply port (the 3rd suction port) and the main suction port (the 1st suction port and the 2nd suction port) are connected to a common inhalation-of-air path -- the above -- gaseous mixture -- un-arranging [which cannot secure easily differential pressure sufficient between the mixed atmospheric pressure in a supply port and the pressure of the combustion chamber to which supercharge is

performed from the above-mentioned main suction port, and receives remarkable constraint in the layout of an inhalation-of-air path] occurs.
[0004] as a means cancel such un-arranging -- the above -- gaseous mixture -- although it is possible to mix the air which connected air pressurization means, such as an air pump, to the supply port, and pressurized it compulsorily with this air pressurization means, and a fuel, if such a special air pressurization means is added, while the structure of the whole equipment will be complicated, an engine load increases by the drive of the above-mentioned air pressurization means, and aggravation of fuel consumption will be caused.
[0005] without this invention is easy structure and increases especially an engine load in view of such a situation -- gaseous mixture -- it aims at offering the suction system of the engine which can perform stratification-ization of the combustion chamber by supply.
[0006]
[Means for Solving the Problem] As above-mentioned The means for solving a technical problem, this invention Opening is carried out to the above-mentioned combustion chamber with the main suction port which carries out opening to a combustion chamber, and is opened and closed by the inlet valve. In the engine with which it has a feed zone and the valve-opening stage of the above-mentioned closing motion valve was set up at the stage later than the valve-opening stage of the above-mentioned inlet valve and the gaseous mixture which supplies the gaseous mixture of air and a fuel to a combustion chamber after it was opened and closed by the closing motion valve and this closing motion valve has opened -- the above -- gaseous mixture -- the clausilium stage of the above-mentioned closing motion valve with a stage adjustable means to make it change in the range within a compression stroke, while making space in a feed zone into closing space At the time of engine high-speed operation, it has the stage control means which controls the above-mentioned stage adjustable means to delay the clausilium stage of the above-mentioned closing motion valve rather than the time of low r.p.m. operation (claim 1).
[0007] It is more desirable to constitute the above-mentioned stage control means from this equipment so that an engine speed may delay the clausilium stage of the above-mentioned closing motion valve rather than the time of low load driving in the field below fixed at the time of heavy load operation (claim 2).
[0008] moreover -- the low-speed operating range which is under the predetermined rotational frequency to which the engine speed was set beforehand -- gaseous mixture -- an inside high-speed operating range with an engine speed make fuel injection perform within a feed zone, and higher than the above-mentioned low-speed operating range -- the above -- gaseous mixture -- by having the fuel-injection control means to which stop the fuel injection within a feed zone and fuel injection is made to carry out by the above-mentioned main suction port, it depends and outstanding effectiveness like the after-mentioned is acquired (claim 3).
[0009] Fuel injection is made to perform within a feed zone. moreover -- the low-speed operating range which is under the predetermined rotational frequency to which the engine speed was set beforehand -- gaseous mixture -- Stop the fuel injection within a feed zone and fuel injection is made to perform by the above-mentioned main suction port. an inside high-speed operating range with an engine speed higher than the above-mentioned low-speed operating range -- in principle -- the above -- gaseous mixture -- the case where it is in the important point cooling conditions that engine operational status was beforehand set up even if it was in a high-speed operating range during the above -- exceptional -- the above -- gaseous mixture -- you may have the fuel-injection control means to which fuel injection is made to carry out within a feed zone (claim 4). In this case, as the above-mentioned important point cooling conditions, it is raised

that an engine speed is in a high-speed operating range in a high-speed operating range during thc above (claim 5), that knocking more than predetermined reinforcement is detected (claim 6), etc.

[0010] Moreover, while having the swirl control means which is equipped with two or more main suction ports, prepares a swirl control valve only in some main suction ports of them, and controls the opening of this swirl control valve by each above-mentioned equipment Constitute the above-mentioned swirl control means, or so that the opening of the above-mentioned swirl control valve may be increased rather than the case where an engine is in a combustion unstable state when an engine is in a combustion stable state (Claim 7), By what (claim 8) the above-mentioned swirl control means is constituted for so that the opening of the above-mentioned swirl control valve may be decreased rather than other cases when knocking more than predetermined reinforcement has occurred in the engine, it will become still more desirable.

[0011]

[Function] according to equipment according to claim 1 -- gaseous mixture, since space in a feed zone is made into closing space the time of valve opening of the above-mentioned closing motion valve -- first -- gaseous mixture -- since the gaseous mixture in a feed zone is supplied to a combustion chamber -- reverse -- the combustion gas of a combustion chamber -- gaseous mixture, when it is incorporated in a feed zone and a closing motion valve closes in this condition in the middle of a compression stroke gaseous mixture -- without it uses a special air pressurization means by holding the pressure in a feed zone at a pressure higher than the combustion chamber internal pressure at the time of a closing motion valve-opening valve, and using such differential pressure -- the time of the following closing motion valve-opening valve -- gaseous mixture -- it can supply. in addition -- the time of engine high-speed operation -- 1 cycle time -- short -- becoming -- the above -- gaseous mixture -- the gaseous mixture from a feed zone to a combustion chamber, although it is hard coming to carry out supply the clausilium stage of the above-mentioned closing motion valve is delayed for the time of low r.p.m. operation by this equipment at the time of the above-mentioned high-speed operation -- having -- the combustion gas of a pressure higher than that part -- gaseous mixture -- it introduces in a feed zone -- having -- this gaseous mixture, since the differential pressure of feed zone internal pressure and combustion chamber internal pressure is increased irrespective of an engine speed -- gaseous mixture -- the good gaseous mixture from a feed zone to a combustion chamber -- supply is guaranteed.

[0012] moreover, the thing for which the clausilium stage of a closing motion valve is delayed from a low-speed low load field with equipment according to claim 2 when an engine load is expensive (i.e., when it is in the low-speed heavy load operating range which knocking tends [comparatively] to generate), even if it is at the above-mentioned low r.p.m. operation time -- the combustion gas of elevated-temperature high pressure -- gaseous mixture -- it is introduced into a feed zone. thereby -- gaseous mixture -- after once storing the function as the so-called cooling chamber of a feed zone, i.e., hot combustion gas, and cooling this, the function to return to a combustion chamber in the following cycle is raised. Therefore, the rise of whenever [combustion chamber internal temperature] is effectively suppressed in the above-mentioned low-speed heavy load field, and knocking is controlled.

[0013] equipment according to claim 3 -- a low-speed operating range -- gaseous mixture -- a fuel injects within a feed zone -- having -- the above -- gaseous mixture -- by performing supply While flammability is raised by stratification-ization of a combustion chamber, an inside high-speed operating range with an engine speed higher than the above-mentioned low-speed

operating range, namely, stratification combustion in the field in which it is difficult and the direction of flammability of homogeneity combustion improves on the contrary the above -- gaseous mixture -- by suspending the fuel injection within a feed zone and performing fuel injection by the above-mentioned main suction port like the usual suction system, fuel injection which was always suitable for the operational status is performed irrespective of an engine speed. moreover, under the above -- a high-speed operating range -- above -- gaseous mixture -- since the pressure of the combustion gas introduced into a feed zone is high -- such an inside high-speed operating range -- the above -- gaseous mixture -- it becomes unnecessary to use the expensive injector in which the fuel injection in the inside of a high-pressure ambient atmosphere is possible by stopping the fuel injection within a feed zone and -- even if it stops fuel injection in this way -- the above -- gaseous mixture -- since the elevated-temperature combustion gas of a combustion chamber is incorporated in a feed zone -- this gaseous mixture -- the combustion chamber cooling function as the so-called cooling chamber of a feed zone is secured.

[0014] On the other hand, with equipment according to claim 4, even if it is a high-speed operating range during the above The case (claim 5) where an engine speed is in a high-speed, very high operating range when engine operational status is in the important point cooling conditions set up beforehand, case generating of knocking is remarkable -- (claim 6) exceptional -- the above -- gaseous mixture -- fuel injection is performed within a feed zone -- the heat of vaporization of this fuel -- gaseous mixture -- the air in a feed zone is cooled and generating of too much rise of engine temperature or knocking is controlled more notably.

[0015] In each equipment of a more than, when the swirl control valve is prepared in the part of two or more main suction ports, the combustion condition and pressure condition of a combustion chamber are controlled by the opening change. as shown in drawing 4 R> 4 (a), the ventilation resistance of the main suction port increases, combustion chamber internal pressure declines, and specifically, by extracting the opening of the above-mentioned swirl control valve shows to this drawing (b) that much -- as -- gaseous mixture -- gaseous mixture becomes easy to go into a combustion chamber from a feed zone (pin center,large port). And swirl formation of a combustion chamber is promoted by the inhalation of air only from such some main suction ports, and it is urged to stratification-ization by it.

[0016] gaseous mixture when an engine is in a combustion stable state with equipment according to claim 7 here -- when there is comparatively little need for stratification-izing of the combustion chamber by supply and swirl generation, the opening of the above-mentioned swirl control valve increases from the case where an engine is in a combustion unstable state -- having -- the above -- gaseous mixture -- since the amount of supply is controlled -- the part -- gaseous mixture -- the energy loss accompanying receipts and payments of the gas between a feed zone and a combustion chamber is mitigated.

[0017] moreover -- when remarkable knocking has occurred in the engine with equipment according to claim 8, while swirl formation is promoted by extracting the opening of the above-mentioned swirl control valve -- the above -- gaseous mixture -- the air amount of supply from a feed zone to a combustion chamber is increased, whenever [combustion chamber internal temperature] is lowered, and, thereby, the above-mentioned knocking is controlled effectively.

[0018]

[Example] One example of this invention is explained based on a drawing.

[0019] Drawing 1 and the engine shown in 2 are equipped with two or more cylinders 1, and the combustion chamber 2 which carries out volume change with actuation of the piston outside drawing is formed in each cylinder 1. The 1st side port 3 of a Uichi Hidari pair and the 2nd side

port 4 which are the main suction port, the same 1st exhaust air port 5 of a Uichi Hidari pair and the 2nd exhaust air port 6, and the single pin center,large port 7 carry out opening to each combustion chamber 2, and the ignition plug of **** is prepared in the abbreviation center section of each combustion chamber 2.

[0020] Both the above-mentioned side ports 3 and 4 are formed ranging from one flank to a combustion chamber 2 of the cylinder head of ****, and both the exhaust air ports 5 and 6 are formed ranging from the other flanks to a combustion chamber 2 of the above-mentioned cylinder head. The pin center,large port 7 is located between both the above-mentioned side ports 3 and four comrades, and is carrying out opening into the combustion chamber 2 in the location near the above-mentioned ignition plug.

[0021] The opening part of the 1st and 2nd side port 3 and 4 of the above to the above-mentioned combustion chamber 2 It is opened and closed by the 1st and 2nd inlet valve 11 and 12, respectively, and the opening part of the 1st and 2nd exhaust air ports 5 and 6 to a combustion chamber 2 It is opened and closed with the 1st and 2nd exhaust valve 13 and 14, respectively, and the opening part of the pin center,large port 7 to the above-mentioned combustion chamber 2 is opened and closed with the timing valve (closing motion valve) 15. The closing motion drive of these valves 11-15 is carried out by the valve gear of **** which consists of a cam shaft etc. Here, the cam shaft 8 for a drive and the inhalation-of-air cam shaft 9 of the above-mentioned closing motion valve 15 are constituted so that it may interlock mutually, the valve timing adjustable device (stage adjustable means; VTC is called hereafter.) 10 is connected with the cam shaft 8 for a drive of the closing motion valve 15, and the phase of the valve-opening period of each above-mentioned valves 11, 12, and 15 is simultaneously shifted only for the equal amount of include angles by this actuation of VTC10. This VTC10 is switched to ON from OFF in response to the hydraulic pressure supply from a hydraulic circuit 23, and a change-over of this hydraulic pressure supply is performed by turning on and off of change-over solenoid 23a prepared in the above-mentioned hydraulic circuit 23.

[0022] The valve-opening period of the above-mentioned exhaust valves 13 and 14 is set as the period of the time of passing a little next piston top dead center from the period (a piston bottom dead point near [i.e.,]) shown with a curve 42. The above VTC10 the valve-opening period of inlet valves 11 and 12 in the off condition It is switched to the period by the time (at the time in early stages of a compression stroke) of passing a little next piston bottom dead point from the period shown by curvilinear 44A of drawing 2 , i.e., the above-mentioned piston top dead center, from a front time. Conversely, in the state of ON of VTC10, it is switched to the period by the time (at the time in the middle of a compression stroke) of passing the next piston top dead center enough from the time of the period (a piston top dead center near [i.e., / above-mentioned]) shown by curvilinear 44B.

[0023] In the state of OFF of the above VTC10, the period shown by curvilinear 46A of drawing 2 , i.e., an inhalation-of-air line, is switched to the period of a point in time to the time in the middle of a compression stroke of the middle, and the period shown by curvilinear 46B, i.e., an inhalation-of-air line, is conversely switched to the period from the point in time of an anaphase to a compression stroke anaphase in the state of ON of VTC10 at the valve-opening period of the timing valve 15. Therefore, the valve-opening stage of this timing valve 15 is always later than the valve-opening stage of the above-mentioned inlet valves 11 and 12, and a clausilium stage is switched between the middle of a compression stroke, and an anaphase.

[0024] Air installation to each above-mentioned side ports 3 and 4 is performed through an inlet pipe 16. This inlet pipe 16 has common inlet-pipe 16a and surge tank 16b of the downstream of

the inhalation-of-air upstream, and each above-mentioned side ports 3 and 4 are connected to this surge tank 16b. The throttle valve 17 which operates according to accelerator actuation, and the throttle sensor 20 which detects the opening of this throttle valve 17 are formed in above-mentioned common inlet-pipe 16a.

[0025] Among both the above-mentioned side ports 3 and 4 and the pin center,large port 7, the side injector 24 and the pin center,large injector 25 are arranged in the 1st side port 3 and the pin center,large port 7, respectively, the swirl control valve 18 which opens and closes this is formed in the 2nd side port 4, and the closing motion drive of each swirl control valve 18 is carried out by the actuator of ****. And after this swirl control valve 18 has closed, a swirl is formed in a combustion chamber 2 by performing inhalation of air only from the 1st side port 3 of the above.

[0026] gaseous mixture [in / each pin center,large port 7 is connected to the common surge tank 22, and / with these pin center,large port 7 and the above-mentioned surge tank 22 / this invention] -- the feed zone is constituted and the building envelope is closed. And the fuel injected from the above-mentioned pin center,large injector 25 is mixed with air in this pin center,large port 7, and, thereby, gaseous mixture is formed.

[0027] Said exhaust air ports 5 and 6 are connected to the common exhaust pipe 30 through the exhaust manifold 28, and the flueway is constituted by these.

[0028] This engine is equipped with various sensors, such as the engine speed 32 besides the above-mentioned intake air flow sensor 19 or the throttle sensor 20, and a knock sensor. These detecting signals It is inputted into ECU (control unit; a stage control means, a fuel-injection control means, and a swirl control means are constituted)40. By this ECU40 On-off control (namely, on-off control of change-over solenoid 23a) of the above VTC10, opening control of the swirl control valve 18, fuel-injection control of each injectors 24 and 25, etc. are performed. Concretely, this ECU40 is constituted so that the following control action may be performed.

[0029] 1) Closing motion control of the swirl control valve 18 : engine-speed N makes opening of the swirl control valve 18 min in a with an engine speed [N] of less than two set up beforehand field, and the above-mentioned engine-speed N makes the opening of the swirl control valve 18 increase in a with an above-mentioned engine speeds [N] of two or more field, as shown in drawing 3 . Furthermore, the increment in a minute amount of the opening of the above-mentioned swirl control valve 18 is carried out rather than the case where it judges with an engine being in a combustion unstable state when it judges with an engine being in a combustion stable state based on the detecting signal of an engine speed sensor 32 or a knock sensor 34, and more conversely than the case of being other, when knocking detected with the knock sensor 34 is more than predetermined reinforcement, minute amount reduction of the opening of the above-mentioned swirl control valve 18 is carried out.

[0030] 2) On-off control of VTC10 : the above-mentioned engine-speed N switches VTC10 for the above VTC10 to ON off in a with a rotational frequency [N] of less than one set up beforehand field in a change and a with an above-mentioned rotational frequencies [N] of one or more field (predetermined operating range).

[0031] 3) Fuel-injection control : about the fuel injection from the pin center,large injector 25, as a continuous line 51 shows to drawing 3 , engine-speed N makes a fuel-injection flow rate increase with the rise of an engine speed in the low-speed operating range of under the predetermined engine speed N3 (> N1) until it results in the above-mentioned engine speed N1, and decreases a fuel-injection flow rate with the rise of an engine speed in a field higher than an engine speed N1. Fuel injection is stopped in an inside high-speed operating range higher than an engine speed N3. The fuel injection from the side injector 25 is made to perform only in the field

more than a predetermined engine speed, and makes fuel oil consumption increase with the rise of engine-speed N, as shown in this drawing continuous line 52.
[0032] Next, an operation of this equipment is explained.
[0033] First, in the predetermined operating range of the fixed rotational frequency N1, VTC10 has off engine-speed N, and the valve-opening period of inlet valves 11 and 12 and the timing valve 15 is switched to the advancing side, respectively, as shown in the curves 44A and 46A of drawing 2 . for this reason, in each cycle, exhaust valves 13 and 14 open from the piston bottom dead point this side after explosion, and the combustion gas in a combustion chamber 2 discharges through the exhaust air port 5 and 6 grades -- having -- subsequently -- inlet valves 11 and 12 -- opening -- the inside of a combustion chamber 2 -- a side port 3 -- leading (the side port 4 being mostly closed by the swirl control valve 18.) -- it leads and new mind is introduced. Furthermore, before ending like this inhalation-of-air line, the gaseous mixture currently formed in the pin center,large port 7 is drawn in a combustion chamber 2 by opening the timing valve 15. And if it passes through a piston bottom dead point, while inlet valves 11 and 12 will close, shortly, the gas in a combustion chamber 2 is introduced into the above and reverse in the pin center,large port 7 with a piston rise, and the timing valve 15 is closed in the middle of a compression stroke after this installation. the gaseous mixture which consists of each pin center,large port 7 and a surge tank 22 here, since space in a feed zone is made into closing space By closing the timing valve 15 in the middle of a compression stroke as mentioned above The pressure in the pin center,large port 7 will be held at a pressure higher than combustion chamber 2 internal pressure at the time of valve opening of the following timing valve 15, and the gaseous mixture in the pin center,large port 7 is again introduced by this differential pressure in a combustion chamber 2 at the time of valve opening next to the above-mentioned timing valve 15. namely, -- without it uses a special air pressurization means -- the gaseous mixture from the pin center,large port 7 to into a combustion chamber 2 -- while the structure of a part and equipment where supply will be made and an air pressurization means becomes unnecessary in this way is simplified, increase of the engine load by the drive of an air pressurization means is lost.
[0034] by the way -- if engine-speed N goes up and 1 cycle time becomes short with such equipment, since the valve-opening time amount of the timing valve 15 will also become short, if any means is not adopted, either -- the gaseous mixture from the pin center,large port 7 to into a combustion chamber 2 -- supply or air supply becomes difficult. However, with this equipment, if engine-speed N goes into a with a rotational frequencies [N] of one or more predetermined field Since the valve-opening period of inlet valves 11 and 12 and the timing valve 15 is delayed as VTC10 is switched to ON and it is shown in the curves 44B and 46B of drawing 2 , the pressure in that part pin center,large port 7 is heightened more, and the differential pressure between the inside of the combustion chamber 2 in the pin center,large port 7 increases -- having -- this sake -- an engine speed -- a less than one N field -- the same -- the above -- gaseous mixture -- supply or air supply is kept good.
[0035] The reason is as follows. Drawing 5 shows the relation between an engine crank tooth lead angle, cylinder internal pressure (combustion chamber internal pressure), and pin center,large port 7 internal pressure. cylinder internal pressure rises [as shown in this drawing,], so that the above-mentioned crank tooth lead angle is large, and the next piston top dead center is approached namely,. On the other hand, like the inhalation-of-air line before the above-mentioned piston bottom dead point, even if a crank angle changes during a period, cylinder internal pressure does not change so much. Therefore, when an engine speed delays the valve-opening period of the timing valve 15 in an one or more N field as mentioned above, more high-

pressure combustion gas can be introduced into the above-mentioned pin center,large port 7 during this valve-opening period, and even if this valve-opening period is short, it will become possible to hold pin center,large port 7 internal pressure to a sufficiently high pressure.
[0036] Furthermore, the following effectiveness can be acquired in this example.
[0037] (a) The inside high-speed operating range of three or more N, i.e., stratification combustion, is difficult, and in the field in which the direction of flammability of homogeneity combustion improves on the contrary, since an engine speed stops the fuel injection by the pin center,large injector 25 and he is trying to inject a fuel only from the side injector 24 as well as the usual suction system, it can perform fuel injection suitable for an engine speed. Moreover, since the pressure of the combustion gas introduced into the pin center,large port 7 as mentioned above by the high-speed operating range during the above is high, there is an advantage it becomes unnecessary to use the expensive injector in which the fuel injection in the inside of a high-pressure ambient atmosphere is possible as this pin center,large injector 25 by stopping the fuel injection by the above-mentioned pin center,large injector 25 by such inside high-speed operating range. And even if it stops fuel injection in this way, the high-pressure elevated-temperature combustion gas in a combustion chamber 2 is incorporated, the function 7, i.e., this pin center,large port, as the so-called cooling chamber of the pin center,large port 7, it once stores and cools in it, and the function to return into a combustion chamber 2 after that is fully secured.
[0038] (b) The ventilation resistance in a side port 4 increases, and combustion chamber internal pressure declines, so that the opening of the swirl control valve 18 is extracted with the above-mentioned equipment, as shown in drawing 4 (a). it is shown that much in this drawing (b) -- as -- gaseous mixture, although gaseous mixture becomes easy to go into a combustion chamber from a feed zone (pin center,large port) gaseous mixture when an engine is in a combustion stable state in the above-mentioned example here, when there is comparatively little need for stratification-izing of the combustion chamber by supply and swirl generation since the opening of the above-mentioned swirl control valve 18 is increased from the case where an engine is in a combustion unstable state -- this -- gaseous mixture -- the energy loss by receipts and payments of the gas between the pin center,large port 7 and a combustion chamber 2 is mitigable by controlling the amount of supply. On the contrary, while this promotes swirl formation since he is trying to extract the opening of the above-mentioned swirl control valve 18 when remarkable knocking has occurred, combustion chamber 2 internal pressure is lowered, the air amount of supply from the above-mentioned pin center,large port 7 to a combustion chamber 2 can be increased, whenever [combustion chamber internal temperature] can be lowered, and it becomes possible to control the above-mentioned knocking effectively by fall whenever [such swirl promotion and combustion chamber internal temperature].
[0039] In addition, it is also possible for this invention not to be limited to such an example, but to take the following modes as an example.
[0040] (1) In the above-mentioned example, although he is trying for an engine speed to delay the valve-opening period of the timing valve 15 in the other field as a predetermined operating range for the field more than fixed irrespective of an engine load Since it is easy to generate knocking among low-speed operating range in the field where an engine load is comparatively expensive Also in such a low-speed heavy load field, delay the valve-opening period of the timing valve 15, and the combustion gas of elevated-temperature high pressure is incorporated by the inside of the pin center,large port 7. By making the combustion chamber cooling function as the so-called cooling chamber of the pin center,large port 7 raised, it becomes possible to

avoid the above-mentioned knocking beforehand.
[0041] (2) Although said 1st example showed what delays the both sides of the clausilium stage of the timing valve 15, and a valve-opening stage by actuation of VTC10, you may make it delay only the clausilium stage of the timing valve 15, for example by change-over of a cam etc. Moreover, in the above-mentioned example, the valve-opening period of inlet valves 11 and 12 is changed with the timing valve 15, and it is also possible to acquire the effectiveness of this invention, without changing the valve-opening period of these inlet valves 11 and 12.
[0042] (3) Although engine-speed N is stopping the fuel injection from the pin center,large injector 25 uniformly in the inside high-speed operating range of three or more N in the above-mentioned example Even if it is such an inside high-speed operating range, when it is in the important point cooling conditions that engine operational status was set up beforehand, for example, when an engine speed is in a high-speed, very high operating range, or when generating of knocking is remarkable By constituting ECU40 so that a fuel may be made to inject from the pin center,large injector 25 in the above-mentioned pin center,large port 7 exceptionally the heat of vaporization of this injected fuel -- gaseous mixture -- it is possible to cool the air in a feed zone and to control effectively generating of too much rise of engine temperature or knocking. Moreover, if opening reduction of the swirl control valve 18 performs a certain amount of knocking control like the above-mentioned example, and it is still made to perform control of injecting a fuel from the above-mentioned pin center,large injector 25, and controlling knocking further when inadequate, it will become possible to perform knocking control effectively covering two or more phases.
[0043] (4) It may be single, when the main inhalation-of-air number of connections may not be asked in this invention, but three or more of these may be formed and it does not form the swirl control valve 18.
[0044]
[Effect of the Invention] Space in a feed zone is made into closing space. the gaseous mixture which carries out opening of this invention to a combustion chamber as mentioned above -- this gaseous mixture, since the valve-opening stage of the closing motion valve of a feed zone is delayed rather than the valve-opening stage of the inlet valve in the main suction port and a clausilium stage is set up in the middle of a compression stroke the above -- gaseous mixture -- a pressure sufficiently high in a feed zone -- it can store -- this gaseous mixture -- by using the differential pressure of the pressure in a feed zone, and combustion chamber internal pressure without it uses a special air pressurization means -- good gaseous mixture -- it is effective in the ability for it to be able to supply, and simplify the structure of equipment by the abbreviation of such an air pressurization means, and mitigate an engine load, and raise fuel consumption.
[0045] furthermore -- since he is trying to delay the clausilium stage of the above-mentioned closing motion valve rather than the time of low r.p.m. operation with this equipment at the time of high-speed operation of an engine -- the combustion gas of the higher pressure in this field -- gaseous mixture -- in spite of shortening the valve-opening period of a closing motion valve by introducing in a feed zone at the time of the above-mentioned high-speed operation -- gaseous mixture -- the good gaseous mixture from a feed zone to a combustion chamber -- supply is securable like the time of low r.p.m. operation.
[0046] Moreover, since he is trying to delay the clausilium stage of the above-mentioned closing motion valve with equipment according to claim 2 compared with the time of low load driving at the time of heavy load operation even if an engine speed is a field below fixed such delay -- the combustion gas of elevated-temperature high pressure -- gaseous mixture -- a feed zone --

introducing -- this gaseous mixture -- by raising the function as the so-called cooling chamber of a feed zone The rise of the engine temperature in the above-mentioned low-speed heavy load field is suppressed, and there is effectiveness which can prevent knocking which is easy to generate especially in this field.

[0047] equipment according to claim 3 -- a low-speed operating range -- gaseous mixture -- fuel injection is performed within a feed zone -- making -- the above -- gaseous mixture -- by supplying While raising flammability by stratification-ization by the combustion chamber, an inside high-speed operating range with an engine speed higher than the above-mentioned low-speed operating range, namely, stratification combustion in the field in which it is difficult and the direction of flammability of homogeneity combustion improves on the contrary the above -- gaseous mixture -- by stopping the fuel injection within a feed zone and carrying out fuel injection by the above-mentioned main suction port like the usual suction system, fuel injection which was always suitable for the operational status can be performed irrespective of an engine speed. moreover, under the above -- a high-speed operating range -- above -- gaseous mixture -- since the pressure of the combustion gas introduced into a feed zone is high -- such an inside high-speed operating range -- the above -- gaseous mixture -- by stopping the fuel injection within a feed zone, the need of using the expensive injector in which the fuel injection in the inside of a high-pressure ambient atmosphere is possible can be abolished, and cost can be reduced further. and -- even if it stops fuel injection in this way -- this gaseous mixture -- after once storing the elevated-temperature combustion gas of the combustion chamber cooling function as the so-called cooling chamber of a feed zone, i.e., the above-mentioned combustion chamber, and cooling, the function to return to a combustion chamber is securable.

[0048] On the other hand, with equipment according to claim 4, even if it is a high-speed operating range during the above The case (claim 5) where an engine speed is in a high-speed, very high operating range when engine operational status is in the important point cooling conditions set up beforehand, When generating of knocking is remarkable (claim 6) exceptional -- the above -- gaseous mixture -- since it is made to carry out fuel injection within a feed zone -- the heat of vaporization of this fuel -- gaseous mixture -- generating of too much rise of engine temperature or knocking can be more effectively controlled by cooling the air in a feed zone.

[0049] gaseous mixture when an engine is in a combustion stable state with equipment according to claim 7, when there is comparatively little need for stratification-izing of the combustion chamber by supply and swirl generation Since he is trying to increase the opening of the above-mentioned swirl control valve from the case where an engine is in a combustion unstable state the pressure buildup of the combustion chamber accompanying the increment in opening of such a swirl control valve -- the gaseous mixture to this combustion chamber -- controlling the amount of supply -- the above -- gaseous mixture -- there is effectiveness which can mitigate the energy loss by receipts and payments of the gas between a feed zone and a combustion chamber.

[0050] moreover -- while this promotes swirl formation since he is trying to extract the opening of the above-mentioned swirl control valve when remarkable knocking has occurred in the engine with equipment according to claim 8 -- the above -- gaseous mixture -- the amount of supply can be made to be able to increase, whenever [combustion chamber internal temperature] can be lowered, and the above-mentioned knocking can be controlled effectively generally.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the whole engine block diagram in one example of this invention.

[Drawing 2] It is the graph which shows the valve-opening timing of each valve set up in the above-mentioned engine.

[Drawing 3] It is the graph which shows the relation of the engine speed and fuel-injection flow rate in the above-mentioned engine.

[Drawing 4] the graph which shows the relation of the opening of a swirl control valve and the ventilation resistance of an inhalation-of-air path, and (b) -- the gaseous mixture from the opening and the pin center,large port of the above-mentioned swirl control valve -- it is the graph which shows relation with a supply flow rate. [in / in (a) / the above-mentioned engine]

[Drawing 5] It is the graph which shows relation with the crank angle, cylinder internal pressure, and pin center,large port internal pressure in the above-mentioned engine.

[Description of Notations]

1 Cylinder
2 Combustion Chamber
3 1st Side Port (the Main Suction Port)
4 2nd Side Port (the Main Suction Port)
7 Pin Center,large Port (Gaseous Mixture Feed Zone Configuration)
10 VTC (Stage Adjustable Means)
11 12 Inlet valve
18 Swirl Control Valve
22 Surge Tank (Gaseous Mixture Feed Zone Configuration)
25 Pin Center,large Injector
32 Engine Speed Sensor
34 Knock Sensor
40 ECU (Stage Control Means, Fuel-Injection Control Means, and Swirl Control Means)

[Translation done.]